

## CHAPTER IX

### SPECIAL TOPICS

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This chapter summarizes various topics and analyses that, in addition to information in the appendices and reference documents, supported the development and evaluation of concept plans and initial alternatives. Special topics discussed in this chapter include the following:

- Concept plan cost estimates
- Less-costly Environmental Water Account (EWA) replacement supply
- Preliminary water operations modeling
- Allocation of project costs
- Potential financing arrangements
- Project integration

#### CONCEPT PLAN COST ESTIMATES

As described in **Chapters VII** and **VIII**, eight concept plans were formulated to facilitate comparison of a broad range of potential actions. The alternatives chosen are intended to identify concept plans that may warrant further development. Specific sizes and/or combinations of plan features will be accomplished in the next phase of the feasibility study. Further, at this phase of the feasibility study, the cost estimates were developed from existing and available sources and are at a planning level of detail appropriate for identifying trends in cost-effectiveness between the numerous potential combinations of facilities, rather than to derive absolute project costs. Future studies will need to examine more closely the most effective and efficient facility sizes and combinations.

**Table IX-1** summarizes the first costs, implementation costs, and annual costs of the eight concept plans. The facility sizes represented in the concept plans were selected to provide a level basis for comparing the plans while also considering apparent trends in the cost-effectiveness of various facility combinations. This section describes major facilities considered in the cost estimates, followed by a discussion of how the first costs, implementation costs, and annual costs shown in **Table IX-1** were calculated.

TABLE IX-1  
SUMMARY OF CONCEPT PLAN COSTS

Concept Plans	Bay Area Water Supply Reliability			EWA Replacement Supply		Combined Objectives		
Distinguishing Features	<sup>1</sup> Raise Los Vaqueros Dam In-Place	<sup>2</sup> Enlarge Los Vaqueros Dam & Reservoir	<sup>3</sup> Desalination with Storage (Enlarge Los Vaqueros)	<sup>4</sup> Enlarge Los Vaqueros with Dyer Canal Interlie	<sup>5</sup> Enlarge Los Vaqueros with Bethany Reservoir Interlie	<sup>6</sup> Water Supply/ EWA Combination - Dyer Canal Interlie	<sup>7</sup> Water Supply/ EWA Combination - Bethany Reservoir Interlie	<sup>8</sup> Water Supply/ EWA Combination with Water Quality
Los Vaqueros Capacity (TAF)	125	500	500	500	500	500	500	500
Delta Pumping Capacity (cfs) <sup>1</sup>	750	750	750	1,000	1,750	1,750	1,750	1,750
Los Vaqueros to SBA Interlie	Dyer Canal	Dyer Canal	Dyer Canal	Dyer Canal	Bethany Reservoir	Dyer Canal	Bethany Reservoir	Dyer Canal
Desalination Capacity (mgd)	-	-	20	-	-	-	-	-
<b>First Cost (\$ millions)</b>								
Lands	2	17	32	17	17	17	17	17
Recreation Relocations	1	5	5	5	5	5	5	5
Construction								
Intake Facilities	18	18	18	29	53	53	53	53
Delta Conveyance	18	18	18	28	55	55	55	55
Pipelines	77	96	96	114	185	183	185	183
Pump Stations & Related Facilities	97	143	143	169	207	252	207	252
Dam	44	285	285	285	285	285	285	285
Power Facilities	10	10	10	11	16	16	16	16
Desalination Plant & Appurtenance	-	-	115	-	-	-	-	-
Cultural Resources	5	12	14	14	16	17	16	17
Environmental Mitigation	13	30	35	34	41	43	41	43
Contingency (Construction)	71	158	189	183	220	232	220	232
Planning, Engineering, & Design	43	95	113	110	132	139	132	139
Construction Management	28	63	74	73	88	93	88	93
<b>Total</b>	<b>427</b>	<b>950</b>	<b>1,131</b>	<b>1,057</b>	<b>1,320</b>	<b>1,390</b>	<b>1,320</b>	<b>1,390</b>
<i>Update from 2002 to 2004<sup>2,3</sup></i>	<i>474</i>	<i>1,053</i>	<i>1,258</i>	<i>1,172</i>	<i>1,465</i>	<i>1,541</i>	<i>1,465</i>	<i>1,541</i>

TABLE IX-1 (CONT.)

Concept Plans	Water Supply Reliability			EWA Replacement		Combination Objectives		
Distinguishing Features	1 Raise Los Vaqueros Dam In-Place	2 Enlarge Los Vaqueros Dam & Reservoir	3 Desalination with Storage (Enlarge Los Vaqueros)	4 Enlarge Los Vaqueros with Dyer Canal Intertie	5 Enlarge Los Vaqueros Reservoir with Bethany Intertie	6 Water Supply/ EWA Combination - Dyer Canal Intertie	7 Water Supply/ EWA Combination - Bethany Reservoir Intertie	8 Water Supply/ EWA Combination with Water Quality
<b>Present Value Cost (\$ Millions) <sup>4</sup></b>								
First Cost	474	1,053	1,258	1,172	1,465	1,541	1,465	1,541
Interest During Construction (IDC)	54	151	181	167	210	220	210	220
O&M, Major Replacement, and Energy	192	436	831	248	335	399	365	399
<b>Total<sup>4</sup></b>	<b>720</b>	<b>1,640</b>	<b>2,270</b>	<b>1,590</b>	<b>2,010</b>	<b>2,160</b>	<b>2,040</b>	<b>2,160</b>
KEY: cfs = cubic feet per second	ELV = Enlarge Los Vaqueros			mgd = million gallons per day		SBA = South Bay Aqueduct		
	EWA = Environmental Water Account			O&M = operation and maintenance		TAF = thousand acre-feet		

Notes:

1. Includes existing diversion and pumping capacity of 250 cfs at Old River.
2. Costs updated to October 2004 price levels.
3. Rounded to nearest \$10 million.
4. Summation of first cost, interest during construction, and present value of a uniform series of costs over a 100-year period of analysis and a 5-3/8 percent interest rate.
5. Power generation facilities and associated costs not included in the Los Vaqueros to Bethany Reservoir intertie estimates. Future studies will evaluate whether power generation facilities would be cost effective in conjunction with this intertie option.

## Facilities Associated with Enlarging Los Vaqueros Reservoir

Three major components are associated with enlarging Los Vaqueros Reservoir for the purpose of either increasing San Francisco Bay Area (Bay Area) water supply reliability or providing replacement supplies for the EWA: (1) constructing new and modifying existing Sacramento-San Joaquin Delta (Delta) intake(s), pumping, and conveyance facilities to the reservoir, and constructing a small forebay (balancing reservoir); (2) raising Los Vaqueros Dam and increasing the size of Los Vaqueros Reservoir; and (3) constructing pumping and transmission facilities from Los Vaqueros Reservoir to the South Bay Aqueduct (SBA) or Bethany Reservoir. Highlights of each major component are presented below.

### *Delta Intake, Pumping, and Conveyance Facilities*

Numerous potential combinations of facilities exist to divert water from the Delta and pump and convey the water to Los Vaqueros Reservoir, while continuing to support the existing connections with Contra Costa Water District (CCWD) water supply system components. These options range from retaining the existing diversion facility at Old River but increasing pumping and conveyance reliability to accommodate the increased head associated with enlarging the reservoir, to constructing a new diversion facility in the central Delta with new pumping facilities and a pipeline to convey water to the expanded reservoir. For this analysis, five different configurations, shown in **Table IX-2**, were considered in combination with several sizes of reservoir enlargement. Each of the diversion configurations would include new fish screens (including expansion or modification of the existing Old River diversion facility). A new central Delta diversion facility also would be designed to reduce the likelihood of attracting fish to the facility.

**TABLE IX-2**  
**DELTA DIVERSION CAPACITIES CONSIDERED**

<b>Total Diversion Capacity (cfs)</b>	<b>Old River Diversion</b>	<b>New Central Delta Diversion</b>
<b>250</b>	Existing	-
<b>500</b>	Expand existing by 250 cfs	-
<b>750</b>	Existing	500 cfs
<b>1,000</b>	Expand existing by 250 cfs	500 cfs
<b>1,750</b>	Expand existing by 500 cfs	1,000 cfs

KEY: cfs = cubic feet per second

The increased pumping rates would range from 112,000 gallons per minute (gpm) for a 250 cubic feet per second (cfs) increase in capacity, to about 673,000 gpm for a 1,500 cfs increase (representing a total pumping capacity of 1,750 cfs, including existing capacity at Old River). The static lifts would range from 340 feet to about 568 feet for a 200,000 acre-foot increase in reservoir capacity to 685 feet for a 400,000 acre-foot increase in capacity. The total number of pumps would range from as few as three for a 250 cfs facility to as many as eighteen for a 1,750 cfs diversion facility.

Depending on the pumping capacities and pumping heads required, single or parallel pipelines would be constructed to convey water to the expanded reservoir. New pipelines would be high pressure, motor lined and coated steel piping with sizes ranging from about 132 to 144 inches. The pipeline(s) would traverse a distance of about 9.32 miles from the Delta to the enlarged reservoir.

### ***Enlarge/Replace Los Vaqueros Dam, Spillway, and Appurtenances***

Six potential reservoir sizes were considered: 125,000, 150,000, 200,000, 300,000, 400,000, and 500,000 acre-feet. These represent increases in the current capacity of 25,000 to 400,000 acre-feet. The 25,000 acre-foot increase corresponds to a dam raise of about 15 feet, the likely maximum height the existing structure can be raised without major reconstruction. Larger dam raises would require construction of a new dam a short distance from the existing facility. Preliminary engineering studies have indicated that locating the new dam upstream from the existing structure would be preferable to a downstream location. This is primarily because an upstream dam would require fewer materials, have less environmental impacts, have a shorter construction duration, and avoid potential geologic hazards downstream from the existing dam. Similar to the existing facility, the new spillway likely would be located on the left (north) abutment of the new dam and be sized to pass the Probable Maximum Flood (PMF), which has a maximum inflow of about 21,500 cfs. Significant expansion of the reservoir also would require construction of a new balancing reservoir and flow control station near the new dam. These facilities would not be required for the 15-foot dam raise.

### ***Los Vaqueros Delivery Intertie***

A range of potential conveyance capacities for the intertie between the reservoir and the SBA was not evaluated at this time; consequently, all concept plans assume a capacity of 430 cfs for the intertie (representing the maximum future capacity of the SBA). However, future studies likely will find that smaller pumping and conveyance capacities are more cost-effective in combination with specific reservoir enlargements. Two potential intertie connection locations are identified in this report: the SBA at the Dyer Canal surge pool, and Bethany Reservoir near the South Bay Pumping Plant. The new intertie from Los Vaqueros Reservoir to the SBA at the Dyer Canal primarily would include a pump station and a 90-inch-diameter pipeline traveling 6 to 7 miles, depending upon the capacity and alignment. Preferred alignments have been identified for the intertie to the SBA at the Dyer Canal and will be evaluated in greater detail in the next phase of study.

A new intertie from Los Vaqueros to Bethany Reservoir primarily would include a reinforced concrete gravity pipeline extending approximately 9 miles from Los Vaqueros dam to Bethany Reservoir, at or near the existing South Bay Pumping Plant. The South Bay Pumping Plant would be used to deliver water to SBA agencies. Due to the large elevation difference between Los Vaqueros and Bethany reservoirs, a potential exists to include power generation facilities with the intertie to help offset pumping costs associated with deliveries to the reservoir or to SBA users. Additional study is needed to determine the feasibility of power facilities and compare facility costs with the energy produced. Consequently, power facilities were not included in the construction cost estimates pending further study.

It should be mentioned that a project including an intertie from Los Vaqueros to Bethany Reservoir would not gain local acceptability without certain operating constraints or restrictions that would satisfy the CCWD Principles of Participation (described in **Chapter II**), in particular that the project would provide for long-term environmental benefits in the Delta by supplying water for the EWA. Water could be supplied for the EWA through either reductions in Delta pumping to benefit fisheries, or replacing south of Delta EWA purchases. In addition, the project could not be operated in conjunction with a peripheral canal or to increase the export of water from Northern California. Just as would be required in the case of a Dyer Canal intertie, permit terms and conditions, as well as contractual arrangements, would be required to ensure that the CCWD principles are satisfied.

### First Costs

First costs for each concept plan are based on the facilities described above and data contained in the 2004 *CALFED Bay-Delta Program Los Vaqueros Reservoir Expansion Studies Planning Report (Planning Report)*, updated to October 2004 price levels. The *Planning Report* cost estimates includes the following major features: (1) Delta intake and conveyance features, (2) pipelines and pump stations from the Delta to Los Vaqueros Reservoir, and from the reservoir to the SBA, (3) a balancing reservoir and flow control stations, (4) Los Vaqueros dam reconstruction for reservoir enlargement, (5) power supply, and (6) recreation enhancements. Costs in the *Planning Report* were prepared for 300,000 and 500,000 acre-foot enlargements of Los Vaqueros, and 1,000 cfs and 1,750 cfs Delta diversion capacities. Preliminary cost estimates for the concept plans are based on these values, with the following exceptions and additions:

- Costs for additional reservoir sizes and pumping capacities were extrapolated from data in the 2004 *Planning Report* based on engineering judgment and other available information.
- Per Federal planning guidelines, first costs for the concept plans include allowances for cultural resources; environmental mitigation; planning, engineering, and design; and construction management.
- Recreation enhancements (described in the *Planning Report*) were not discussed in the concept plans, but an allowance was included for relocating existing recreation facilities impacted by reservoir enlargement.
- Cost estimates for desalination facilities were derived primarily from the October 2003 *Bay Area Regional Desalination Project Pre-Feasibility Study Final Report* prepared by the East Bay Municipal Utility district, CCWD, Santa Clara Valley Water District, and the San Francisco Public Utilities Commission and preliminary data from 2004 prepared for the CALFED Bay-Delta Program Bay Area Water Quality and Water Supply Reliability Study.

**Table IX-3** summarizes the methodology and factors used to estimate costs for the concept plans. Total investment cost is calculated by adding interest during construction (IDC) to the first cost. IDC was calculated according to Department of the Interior, Bureau of Reclamation (Reclamation) guidelines. Construction periods ranging from 2 to 5 years were assumed, depending on the scope of the project.

**TABLE IX-3  
SUMMARY OF COST ESTIMATING METHODOLOGY**

<b>Cost Category</b>	<b>Methodology and Cost Factors</b>
<b>Recreation Relocations <sup>1</sup></b>	\$5 million
<b>Lands</b>	
Land unit cost	\$5,000 / acre
Land requirements for various facilities & facility sizes	Acres:
120,000 acre-foot reservoir	120
150,000 acre-foot reservoir	400
200,000 acre-foot reservoir	870
300,000 acre-foot reservoir	1,620
400,000 acre-foot reservoir	2,380
500,000 acre-foot reservoir	3,140
Pipelines, pump stations, & associated facilities from Delta to Los Vaqueros Reservoir	133
Pipelines, pump stations, & associated facilities from Los Vaqueros Reservoir to SBA	200 <sup>5</sup>
<b>Cultural Resources <sup>2</sup></b>	2%
<b>Environmental Mitigation <sup>2</sup></b>	5%
<b>Contingency <sup>3</sup></b>	25%
<b>Planning, Engineering, &amp; Design <sup>4</sup></b>	12% of subtotal
<b>Construction Management <sup>4</sup></b>	8% of subtotal
<b>CPI (August 2002 to October 2004)</b>	1.109
KEY: CPI = consumer price index      SBA = South Bay Aqueduct	

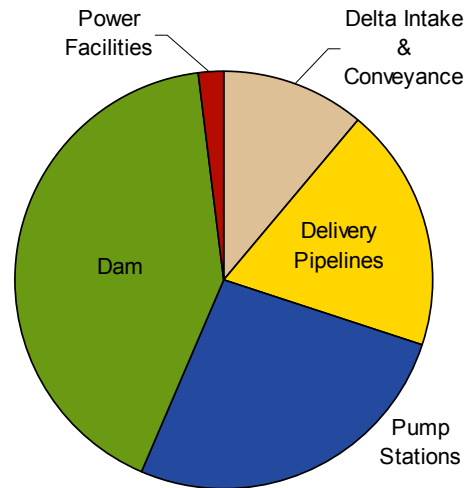
*Notes:*

- The sum of \$5 million was included for relocations associated with enlarging Los Vaqueros Reservoir to 500 thousand acre feet (TAF). Smaller reservoir enlargements included proportionally smaller relocation costs.*
- Cultural resources and environmental mitigation costs were calculated as percentages of the subtotal construction cost, including costs for lands and relocations.*
- Contingency applied to the subtotal of construction, lands, relocations, cultural resources, and mitigation costs.*
- Planning, engineering, and design and construction management costs were calculated as percentages of the total construction cost (including lands, relocations, cultural resources, environmental mitigation, and contingency).*
- Cost varies depending on the intertie location, either the SBA at the Dyer Canal or Bethany Reservoir.*

Estimated first costs ranged from under \$200 million for concept plans that primarily used existing facilities, to about \$1.5 billion for a concept plan that included enlarging Los Vaqueros Reservoir by 400,000 acre-feet and increasing diversion capacity from the Delta to 1,750 cfs. In general, the majority of the first costs for the concept plans was related to enlarging the reservoir (reconstructing the dam and associated facilities), followed by pump stations and pipelines.

**Figure IX-1** illustrates the general contribution of facility costs to the total construction cost for concept plans that include enlarging Los Vaqueros Reservoir to 500,000 acre-feet.

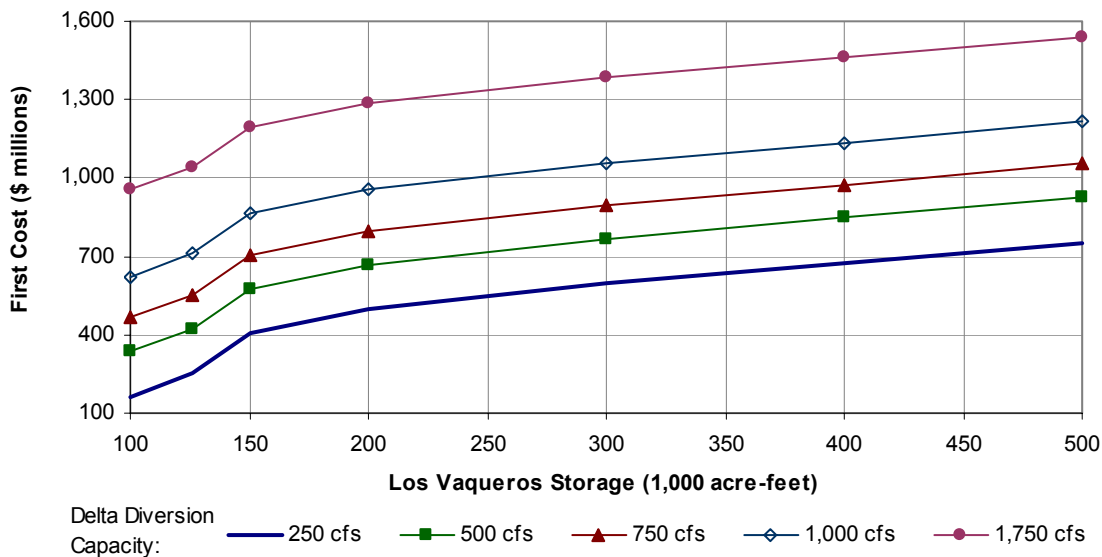
**Figures IX-2 and IX-3** summarize the likely range of first and present value costs, respectively, estimated for various combinations of facilities and facility sizes. Costs are based on a project with an intertie to the SBA at the Dyer Canal. The first cost of a similar sized project with an intertie to Bethany Reservoir would be about 5 percent less.



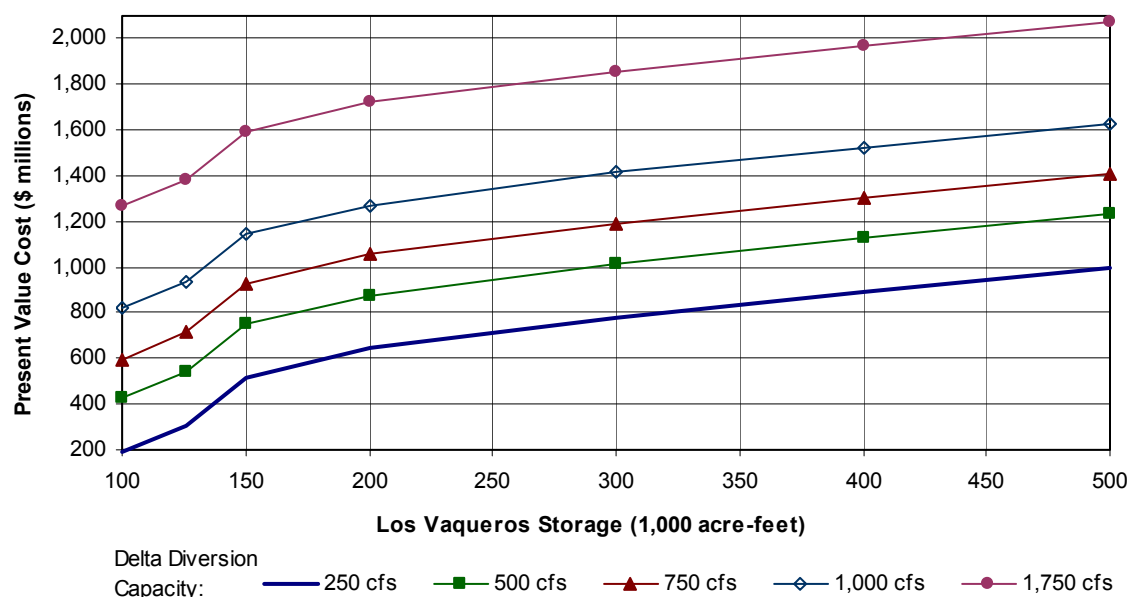
**FIGURE IX-1 – RELATIVE COSTS OF MAJOR COMPONENTS FOR CONCEPT PLANS THAT INCLUDE A 500,000 ACRE-FOOT LOS VAQUEROS RESERVOIR EXPANSION**

### Present Value Costs

Present value costs include the summation of first costs, interest during the construction period; and the present value of major facility replacements, power requirements, and operation and maintenance (O&M) costs. The present value of the regularly occurring annual costs is based on an interest rate of 5-3/8 percent and a project life of 100 years. For this analysis, estimated power costs are based primarily on the present worth value of an expected annual energy cost of \$0.10 per kilowatt-hour (kWh) to divert and pump water from the Delta to the SBA either at Dyer Canal or Bethany Reservoir. Present value cost estimates shown in **Figure IX-3** range from about \$200 million to just under \$2.1 billion.



**FIGURE IX-2 – ESTIMATED FIRST COSTS FOR VARIOUS COMBINATIONS OF INCREASED STORAGE AND DELTA PUMPING CAPACITY WITH DYER CANAL INTERTIE**



**FIGURE IX-3 – ESTIMATED PRESENT VALUE COSTS FOR VARIOUS COMBINATIONS OF INCREASED STORAGE AND DELTA PUMPING CAPACITY WITH DYER CANAL INTERTIE**

## LESS-COSTLY EWA REPLACEMENT SUPPLY

One of the two major planning objectives for the Los Vaqueros Expansion Investigation (LVE) is to determine if enlarging Los Vaqueros Reservoir is less-costly than an increment of Federal involvement in the EWA as currently implemented. Water developed through storage in LVE would provide a portion of the EWA annual water demand, which is currently met primarily through transfer market purchases and implemented through the use of existing facilities. The hydrologic, structural, environmental, social, economic and institutional factors that influence water demands and supplies are subject to great uncertainty. Forecasting future transfer market conditions and costs of implementing the transfers (including environmental and lost opportunity costs) will require significant additional study due to the sources and corresponding ranges of uncertainty for each of these factors. To identify the relationships of key variables over the 100-year project period of analysis, and determine whether water supplies developed from an expanded Los Vaqueros Reservoir would be a less-costly replacement supply for the EWA, further study is needed during the Plan Formulation Report phase of the LVE. Additional refinements of project features, designs, and costs, should also be developed to support this comparison.

## PRELIMINARY WATER OPERATIONS MODELING

The concept plans described in **Chapter VII** were compared using results from preliminary computer modeling. These simulations were performed using a new modeling tool to represent Los Vaqueros Reservoir operations. This section briefly describes the simulation model, its use and results, and future modeling needs for the LVE.

## Background

Assessment of the potential benefits and impacts of an expanded Los Vaqueros Reservoir requires analysis of three interdependent systems: statewide Central Valley Project-State Water Project (CVP-SWP) operations, the Delta, and an expanded Los Vaqueros Reservoir and associated conveyance. The first phase of modeling for the Los Vaqueros Expansion Studies used a spreadsheet model initially developed by CCWD to determine Los Vaqueros Reservoir operations. The spreadsheet model was used in conjunction with two other modeling tools, CALSIM II and DSM2, to determine water supply and water quality inputs. CALSIM II, jointly developed by Reclamation and the California Department of Water Resources (DWR), simulates CVP-SWP operations, reservoir releases and water allocations. DSM2 is a branched one-dimensional hydrodynamic and water quality model of the Delta developed at DWR in the late 1990s. Key DSM2 inputs include tidal stage, boundary inflow and salinity concentration, and operation of flow control structures. CALSIM II and the general CALSIM software are discussed in further detail below.

A typical integrated model simulation is conducted as follows. First, the CALSIM II Common Assumptions baseline model is used to determine monthly data on various Delta flow conditions and CVP-SWP operations, including Delta surplus flows, monthly Export-Inflow ratios, and deliveries to the SBA. Output from the CALSIM II baseline model is then input to the 73-year repeating tide version of DSM2 to obtain Delta water quality at Clifton Court Forebay and at existing and proposed diversion locations in the Delta. The water quality from DSM2, and Delta surplus and Export-Inflow constraints from CALSIM II, are all used as input to the spreadsheet model, which determines the amount of water that can be pumped from the Delta for use by the Los Vaqueros Expansion Project while still ensuring all operating restrictions are met.

However, because the Los Vaqueros Project is an integral part of Delta operations, the revised Delta pumping must be input to the CALSIM II baseline model, and the entire process discussed above must be rerun. By repeating the process, one can ensure that diversions for the Los Vaqueros Reservoir can be checked for consistency with the State Water Resources Control Board (SWRCB) water rights Decision 1641 (D-1641) Delta water quality requirements, and that Delta water quality inputs are correctly modeled.

To simplify the modeling approach described above, and to analyze possible integration of a Los Vaqueros Project with CVP-SWP and EWA operations, Reclamation has funded the development of an integrated Los Vaqueros Reservoir – CALSIM II model using the CALSIM software.

CALSIM is a generalized water resources tool developed by DWR's Bay-Delta Office. The model is entirely data driven and can be applied to most reservoir-river basin systems. The model represents the physical system (reservoirs, streams, canals, pumping stations, etc.) by a network of nodes and arcs. The model user describes the system connectivity and various operational constraints using the modeling language Water Resources Simulation Language (WRESL). CALSIM subsequently simulates system operation using optimization techniques to route water through the network. A linear programming solver determines an optimal set of decisions for each time-step for a set of user-defined priorities (weights) and system constraints. The model is described by DWR (2000) and Draper et al. (2004).

CALSIM II is the application of the CALSIM software to model the CVP and SWP. This application was jointly developed by Reclamation and DWR for planning studies relating to CVP-SWP operations. The primary purpose of CALSIM II is to evaluate the water supply reliability of the CVP and SWP at current or future levels of development (LOD) (e.g., 2001, 2020), with and without various assumed future facilities, and with different modes of facility operations. Geographically, the model covers the drainage basin of the Delta, the CVP (excluding operation of the Friant-Kern Canal), and the entire SWP. CALSIM II provides a set of operations that meet all applicable regulatory and operational constraints in the Central Valley and the Delta.

CALSIM II typically simulates system operation for a 73-year period using a monthly time-step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period, representing a fixed LOD (e.g., 2001 or 2020). The historical flow record from October 1921 to September 1994, adjusted for the influence of land use change and upstream flow regulation, is used to represent the possible range of water supply conditions. It is assumed that the past is a good indicator of future hydrologic conditions.

### **CALSIM-Based Los Vaqueros Reservoir Model**

An integrated Los Vaqueros Reservoir-CALSIM II model is currently being developed to support analysis in subsequent phases of the feasibility investigation. The initial step in this integration process has been conversion of the spreadsheet model to a CALSIM-based model of Los Vaqueros Reservoir operations. The CALSIM-based Los Vaqueros model, similar to the spreadsheet model, requires timeseries inputs derived from CALSIM II and DSM2 for Delta water quality, availability of Delta surplus, and SBA demands (water supply reliability or EWA replacement). Operation of the CALSIM-based Los Vaqueros model was validated by comparing model results to those obtained from the spreadsheet model. The CALSIM-based model has been used for the analysis in this Initial Alternatives Information Report (IAIR). However, model inputs, operating rules and assumptions were obtained from previous modeling efforts conducted using the spreadsheet model.

Due to the preliminary nature of the modeling simulations performed in support of this IAIR, the following considerations should be noted:

- As mentioned above, no significant changes were made to the decision criteria and operational parameters that were integrated into the freestanding CALSIM-based Los Vaqueros model. These parameters will be evaluated and refined as the integrated model is developed. This includes the evaluation of water demands, for both water supply reliability and the EWA, currently incorporated in the model.
- The CALSIM-based Los Vaqueros model used to evaluate the concept plans is not capable of explicitly simulating EWA actions and operations. Future modeling studies will be required to investigate the potential impacts to the CVP and SWP systems of revised EWA operations, and the integration of Los Vaqueros Reservoir operations with San Luis Reservoir.
- Preliminary modeling simulations were designed to evaluate a broad range of potential facilities and operating scenarios associated with an enlarged Los Vaqueros Reservoir. This includes a range of potential Delta export and conveyance capacities, reservoir sizes, and

demand and delivery scenarios. Results from these modeling runs were used to graph project yield as a function of Delta export capacity and reservoir size. These relationships were used in combination with preliminary cost estimates to identify the combination of storage and pumping that might be most effective for a given concept plan, and quantify its potential benefits. However, additional modeling is needed to refine these preliminary facilities combinations and sizes and verify potential plan benefits. The potential for water quality improvements through reoperation of the project also will be explored in future modeling efforts.

- Potential impacts of the concept plans on Delta water quality and CVP-SWP operations have not been evaluated and therefore will be considered in future modeling efforts.

### **Modeling Assumptions**

The following are assumptions used throughout all Los Vaqueros modeling of the concept plans included in this IAIR:

- The achievements of each concept plan were calculated compared to a baseline condition. The baseline condition assumes existing reservoir facilities (100 thousand acre-feet (TAF), 350 cfs capacity at Rock Slough, 250 cfs capacity at Old River, 200 cfs reservoir fill capacity, 350 cfs release capacity), deliveries only to CCWD to meet its anticipated future base demand, and projected operating restrictions as per anticipated changes to the Biological Opinion (BO) discussed below.
- All demand inputs were derived from CALSIM II. For the with-project condition, CCWD demands include its anticipated future demand plus 10 TAF of reliability demand in dry and critically dry years. Further, to optimize use of the reservoir, SBA demands assume full use of an expanded Los Vaqueros to meet water supply needs, therefore restricting the use of other potential water supplies (i.e., Semitropic) to years when the expanded reservoir cannot fully meet demands. Demand inputs also include the use of Los Vaqueros to meet full Table A deliveries to SBA contractors receiving water from the reservoir.
- A Rock Slough Pumping Plant capacity of 30 cfs is reserved for potential use associated with planned development in eastern Contra Costa County that is outside the Los Vaqueros Project service area but within CCWD's boundary.
- The monthly water quality target for Los Vaqueros reservoir is established based on the storage level in the reservoir in June of the previous year, which corresponds to a respective water quality target. This varying target allows for filling the reservoir with water of poorer quality once the reservoir is drawn down below 200 TAF. Water quality targets vary between 55 milligrams per liter (mg/L) chloride to 100 mg/L chloride.
- The CCWD delivered water quality target is 65 mg/L, but this is relaxed in months when water delivered in the without-project condition is greater than 65 mg/L. This rule effectively maximizes the yield of the expanded reservoir while maintaining water quality benefits to CCWD achieved with baseline conditions.

- To address anticipated changes to the BO for environmental constraints, the operating rules for the future expansion of Los Vaqueros Reservoir are not the same as for the reservoir as it is currently operated. In the case of the expanded reservoir, no pumping is allowed at the Old River or Middle River intakes for the months of April and May. The expected adjustments to the BO also relieve all pumping restrictions at Rock Slough, compared to the 30-day no pumping restriction currently imposed.
- An emergency storage level of 50 TAF (for all year types, including 5 TAF of inactive storage) has been established for all Los Vaqueros modeling scenarios. Actual emergency storage levels for the existing reservoir are associated with CCWD's existing biological opinion, and vary by year type from 44 TAF in dry and critically dry years to 70 TAF in all other year types (including inactive storage).
- Deliveries to CCWD for reliability demand are reduced when reservoir storage is below 60 TAF. Maximum deliveries for water supply reliability are reduced linearly, reaching zero once the reservoir is drawn down to emergency storage (50 TAF). This is done to protect the delivery of CCWD base demands.
- The availability of CVP contract water varies between 140 TAF to 177 TAF per contract year (March to February) depending on CCWD demand. Reductions in CVP allocations are not modeled explicitly, as it is assumed that shortages in CVP supply are covered by short-term purchase agreements for north-of-Delta's supplies, as planned in CCWD's Future Water Supply Study Implementation Plan.
- Use of CVP contract water to fill Los Vaqueros Reservoir is restricted to 100 cfs from June through October, with no filling during other times of the year. Rescheduling deliveries of CVP contract water for an expanded facility allows filling of Los Vaqueros Reservoir during periods of relatively high Delta water quality, while minimizing impacts to other CVP contractors or CVP operations. Additional diversion constraints for filling Los Vaqueros Reservoir with CVP contract water are imposed, due to additional water quality concerns, in contract years 1924, 1932, 1977, and 1991.
- The availability of Delta surplus is an input to the model, calculated using CALSIM II model results. Only surplus flows in excess of a buffer are available for diversion to ensure that Los Vaqueros Reservoir operations do not significantly impact delta water quality. The buffer varies from 2,000 cfs to 20,000 cfs depending on conditions.
- Delta surplus is preferentially used over CVP contract water to fill Los Vaqueros Reservoir. Direct diversion of Delta surplus (for direct delivery to CCWD) occurs only when alternate water supplies from the Delta are unavailable.

## Model Details

The network schematic for the CALSIM-based Los Vaqueros Reservoir model is shown in **Figure IX-5**. The model incorporates three cycles in each time-step to determine monthly Delta diversions, reservoir operations, and deliveries for the period of simulation.

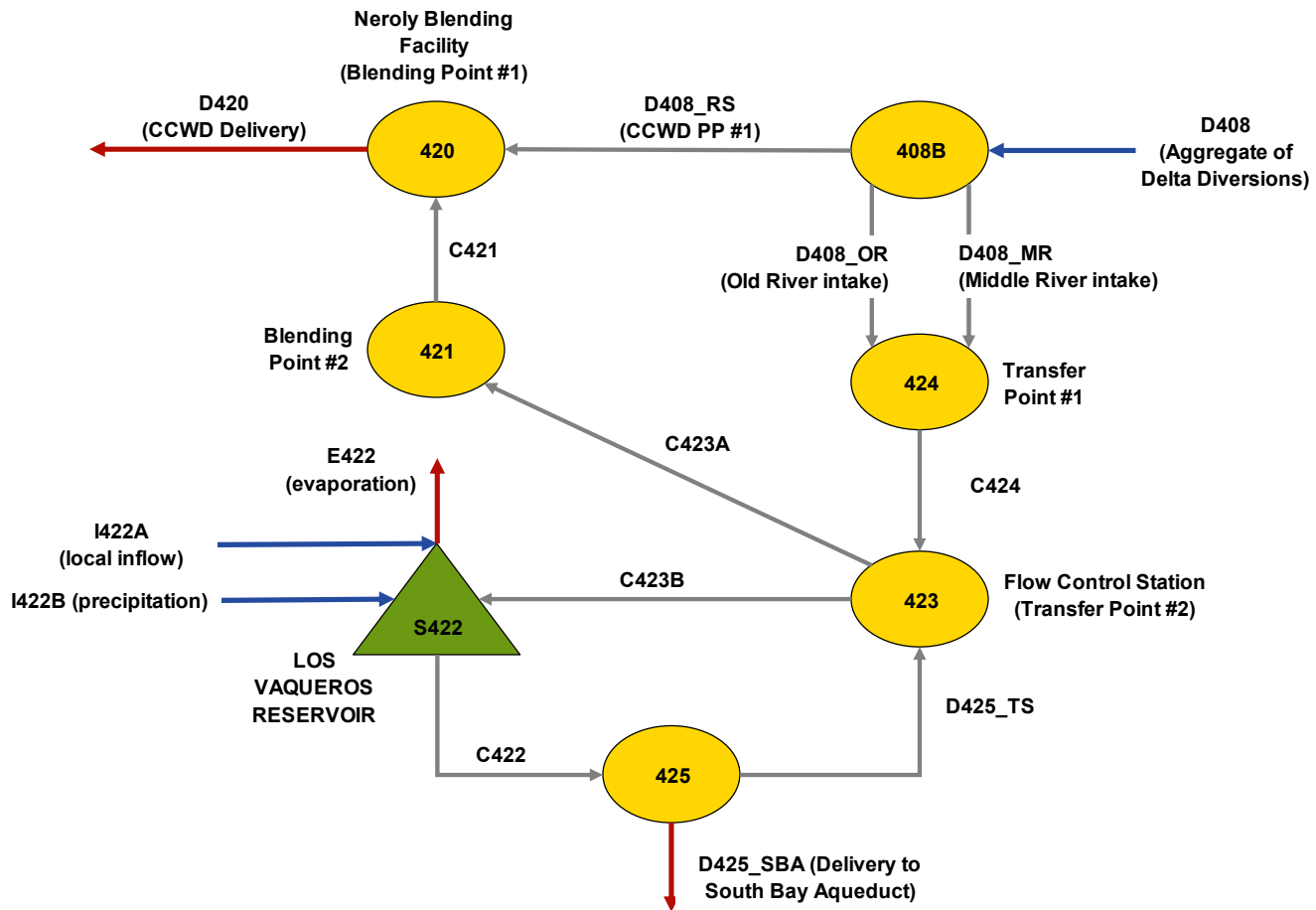


FIGURE IX-5 – MODEL SCHEMATIC FOR EXPANDED LOS VAQUEROS RESERVOIR

The three model cycles are summarized below:

- **Cycle 1** simulates the system in the absence of water quality targets for CCWD service area deliveries or stored water in Los Vaqueros Reservoir. Available water is used to its maximum to meet CCWD service area and SBA/EWA demands, and fill the reservoir. No reservoir releases for blending are made in Cycle 1.
- **Cycle 2** adjusts diversion at Delta intakes and makes blending releases, if necessary, from Los Vaqueros Reservoir to ensure that the CCWD service area is receiving water that meets the delivered water quality target.
- **Cycle 3** maintains the CCWD service area delivered water quality and quantity from Cycle 2, but reduces filling of Los Vaqueros Reservoir, if necessary, to ensure that receiving water and reservoir water mix to a water quality that meets the target for the reservoir.

## Future Operations Modeling

The next step in LVE operations modeling is the integration of the freestanding CALSIM-based Los Vaqueros Reservoir model into CALSIM II. The integrated model will allow for the following:

- Dynamic calculation of Delta surplus
- Dynamic routing of Los Vaqueros Reservoir deliveries along the SBA
- Dynamic integration of Los Vaqueros Reservoir operations for EWA with north-and south-of-Delta purchases, and storage of EWA water in San Luis Reservoir
- Dynamic integration of Los Vaqueros Reservoir operations with CVP-SWP operations

The integrated model also will have the capability to dynamically calculate water quality at Delta intakes, and water quality at Clifton Court Forebay, based on Artificial Neural Network (ANN) routines developed by DWR. This use of CALSIM II water quality predictors to determine Los Vaqueros Reservoir operations will be reviewed. Overall, use of the integrated model will be more efficient, as only CALSIM II and DSM2 will need to be run, instead of the three-model cycle currently used.

The CALFED Common Assumptions working group is developing an updated CALSIM II model for use by all of the ongoing CALFED storage investigations, including the LVE. This model will include the integration of Los Vaqueros Reservoir operations, EWA operations, and various other model refinements and updates. It also will contain recommended existing and future without-project assumptions, such as pumping capacity at Banks and Tracy pumping plants, to promote consistency among CALFED studies and investigations. Because the Common Assumptions model will not be available for use until later in 2005, it could not be used to simulate the initial concept plans for the LVE.

## ALLOCATION OF PROJECT COSTS

Cost allocation is the process of equitably distributing project costs among project purposes to determine repayment according to project beneficiary and project use. It also is a process of defining the allocated costs of a project between Federal and non-Federal interests – usually called cost apportionment. Cost allocations are made to derive an equitable distribution of project costs among Congressionally authorized project purposes. The allocation and repayment of the Federal share of costs of any project would be subject to Federal law and policy. The basic authority for recovering the Federal investment in constructing, operating, and maintaining authorized water resource projects is the Reclamation Project Act of 1939.

The primary purpose of this section is to introduce cost allocation and some preliminary considerations if it is established that an enlargement of Los Vaqueros Reservoir warrants Federal participation. It should be mentioned, however, that the potential Federal role in a project has not yet been identified. Even if one is identified, important issues will need to be resolved such as integration into the CVP, repayment periods, and others.

Cost allocation in a multiple-purpose Federal water resources project is a three-step process:

1. **Identify Costs to be Allocated** - Costs to be allocated include construction costs, interest during construction, and O&M costs.
2. **Allocate Costs to Project Purposes** - For allocation purposes, costs may be evaluated in two categories: separable costs and joint costs. Separable costs are the reduction in financial costs that would result if a purpose were excluded from an alternative. Joint costs are the costs remaining when separable costs are subtracted from the total project cost. Joint costs may be allocated among purposes in proportion to remaining benefits. To accommodate projects with joint costs, the likely cost allocation method would be the separable costs-remaining benefits method (SC-RB).
3. **Calculate Repayment Responsibilities** - The cost allocation process is designed so that costs of project purposes and their benefits can be apportioned to beneficiaries for repayment. Costs allocated to water supply, fish and wildlife, ecosystem restoration, flood control, and hydropower purposes are either fully or partly reimbursable by project beneficiaries. Once project costs and components are identified, project costs may be delineated as the Federal share and the non-Federal sponsor share. The Federal share is allocated among reimbursable and non-reimbursable functions. Reimbursable costs are identified as either separable or joint costs according to project purpose authorization. Separable costs then may be directly attributed to the beneficiaries. Joint costs are allocated to project beneficiaries according to SC-RB principles.

### **Pertinent Terms**

Following are several terms important in the SC-RB process:

- **Separable Costs** - Separable costs are costs that are specifically necessary because a purpose is included in a multiple-purpose project. These costs are determined during plan formulation. The separable cost is the minimum amount to be considered for allocating costs to a given purpose. The separable cost for any specific purpose is determined by subtracting from the costs of the multiple-purpose project the cost of the most economical alternative to obtain the same benefits for the other purposes with the specified purpose omitted.
- **Specific Cost** - Specific costs are the costs of project features normally serving only one specific project purpose, such as water supply. They are costs incurred specifically to add a purpose to a project.
- **Joint Costs** - Joint costs are defined as the total project cost less the separable costs.
- **Joint Use Costs** - Joint use costs are costs of facilities used for more than one purpose, such as a dam and reservoir.
- **Alternative Costs** – Alternative costs are costs of alternative projects with one purpose eliminated. This is to determine the separable costs or the costs of single-purpose projects necessary to obtain the same benefits for the corresponding purpose as for the multiple-purpose project.

- **Reimbursable** – This is the portion of initial Federal investment in a project that beneficiaries repay.
- **Non-Reimbursable** – This is the portion of initial Federal investment in a project that does not require repayment.

### **Purposes to Which Costs Are Allocated**

As noted previously, costs are allocated to project purposes in order to identify repayment responsibilities. For the CVP, reimbursable costs are repaid by water and power contractors while non-reimbursable costs, as authorized by Congressional legislation, are the responsibility of the Federal taxpayer. Reimbursable costs include those allocated to irrigation and municipal and industrial water supply, hydropower, and some fish and wildlife mitigation and some wildlife refuge water supply. Non-reimbursable costs include those allocated to flood control, navigation, water quality improvement, recreation, fish and wildlife enhancement, and some fish and wildlife mitigation and some wildlife refuge water supply.

### ***Fish and Wildlife Enhancement***

A potential authority for Federal participation in fish and wildlife enhancement would be through the Federal Water Project Recreation Act, Public Law (PL) 89-72, as amended by PL 102-575, Section 2804 (Title 28). Under PL 89-72, the Federal Government would pay up to 75 percent of the costs to plan, design, and construct (including interest during construction) the fish and wildlife enhancement elements. The minimum 25 percent non-Federal share would be due on project implementation (construction). Under PL 89-72, up to 50 percent of operation, maintenance, and major replacement costs could be paid for with Federal funding.

### ***Agricultural Water Supply***

Several authorities exist under which a water supply increment or purpose can be considered in cost allocation. One would be The Reclamation Act of 1902, as amended, and another would be The Water Supply Act of 1958, also as amended. The basic difference between the two authorities is the amount of up-front Federal funding for construction and repayment options.

- **The Reclamation Act of 1902, as amended** – Most Reclamation projects, including water supply, have been implemented under this authority. Under the act, the Federal Government could provide up-front funding for implementation (construction) of new water supply, of which 100 percent of the capital cost allocated to agricultural supply is repaid at no interest over a 50-year repayment period. In addition to the no-interest repayment subsidy, “ability-to-pay” provisions of Federal Reclamation Law permit agricultural contractors to apply for additional relief from their capital repayment obligations. Further, 100 percent of O&M costs are non-Federal.
- **The Water Supply Act of 1958, as amended** – Another authorization vehicle that could provide a substantial benefit to a non-Federal agricultural water supply sponsor is The Water Supply Act of 1958. Under this act, eligible projects can receive up to 85 percent total

Federal funding, with at least 35 percent of the non-Federal share due on completion of construction. Again, 100 percent of O&M costs are non-Federal.

### ***M&I Water Supply***

The two basic authorities also governing Federal cost-sharing for M&I water supply are The Reclamation Act of 1902, as amended, and The Water Supply Act of 1958, also as amended.

- **The Reclamation Act of 1902, as amended** – Similar to agricultural water supply, The Reclamation Act of 1902 allows for up-front Federal financing of M&I water supply purposes, with 100 percent repayment of capital costs (including interest during construction). However, repayment includes interest over the 50-year repayment period. O&M costs are the responsibility of the non-Federal sponsor.
- **The Water Supply Act of 1958, as amended** – Development and O&M cost sharing for M&I supplies is the same as described in the previous section for agricultural supplies.

### ***Recreation***

A potential authority for Federal participation would be through PL 89-72, as amended by PL 102-575, Section 2804 (Title 28). Under PL 89-72, Federal cost sharing can be up to 50 percent with no less than 50 percent non-Federal funding, including planning, design, construction, and interest during construction. The non-Federal share of the implementation costs would be provided concurrent with project implementation. Up to 50 percent of the costs for O&M could be provided by the Federal government. Note, however, that recreation is not currently a purpose in the LVE investigation. Further, recreation is currently viewed as having a relatively low priority for Federal involvement.

### ***Application***

As mentioned, the potential for Federal interest and participation in a project to address the planning objectives has not yet been determined for the LVE. Further, the above information is intended only to provide an introduction to cost allocation. Accordingly, application of Federal cost sharing procedures and policies to the LVE will be a major subject in future studies. Assuming that an economically feasible project plan can be determined, it appears that a portion of a project allocated to water supply reliability would be a non-Federal responsibility, although a possibility exists under the Reclamation Act of 1902 for up-front funding. If a portion of a project is allocated to EWA replacement, it could be considered fish and wildlife enhancement, under PL 89-72 as amended, in which case the Federal share could be as much as 75 percent of the total project cost.

## **POTENTIAL FINANCING ARRANGEMENTS**

Construction and operation of a project to address the LVE planning objectives could be accomplished under various financing arrangements involving the Federal Government, State of California, and/or other local project sponsors. Several possible scenarios are described below.

## Construction

Funding for project construction could come from Federal, State, and/or local entities. The process by which funds would be obtained by these agencies is summarized as follows:

- **Federal** – Traditionally, Congress would authorize the Federal interest in the project on the basis of information and recommendations contained in a final Federal Feasibility Report and other documentation. Following project authorization, and subject to Federal and non-Federal implementation agreements, Congress would appropriate funds through the budget process to implement the Federal portion of the project.
- **State of California** – As explained in the April 2004 *Los Vaqueros Expansion Studies Planning Report*, potential construction funding from the State of California would likely come from the issue of general obligation (GO) bonds or revenue bonds. A GO bond would require approval by the State legislature and approval by a majority vote of the public. For state projects that generate revenues from the sale of vendible outputs, such as the SWP, the sponsoring State agency (DWR, in this case) can issue revenue bonds. A State revenue bond could be enacted by statute without voter approval.
- **Other Local Sponsors** – Local funding for construction likely would come from local water agencies that would directly benefit from the project, and funding would be generated from issuance of debt (such as GO bonds or revenue bonds). Other options include loans from the State.

## Operation and Maintenance

Following completion of the construction phase, the project would need to be operated and maintained to consistently accomplish the project purposes over the project life. Although a potential exists for Federal participation in up to 50 percent of a project element allocated to fish and wildlife enhancement under PL 89-72, ongoing O&M normally would be accomplished and funded by project beneficiaries. For water supply reliability, O&M funding would typically come from the sale of the water, depending on how the water was marketed.

## PROJECT INTEGRATION

Additional study and coordination is required to determine how a new project with Federal participation would be implemented and/or integrated with existing projects. Besides Federal processes, State, CALFED, and local processes exist for participation in the funding, construction, and operation of projects. The CALFED ROD established a “beneficiary pays” principle, but it is not clear at this time how that principle compares with Federal standards, or which would take precedence.

However, should a project be identified and implemented that addresses water supply objectives warranting Federal interest, it could potentially be integrated into the Delta Division of the CVP. Delta Division facilities primarily provide for the transport of water through the Delta to contractors served by the Contra Costa and Delta-Mendota canals. The main features of the

Delta Division are the Delta Cross Channel, Contra Costa Canal, Tracy Pumping Plant, and Delta-Mendota Canal. The Delta Division is operated in conjunction with the SWP through the Coordinated Operation Agreement, or COA, to meet the requirements of in-Delta riparian water rights holders and Delta water quality standards imposed by the SWRCB. This and other potential project integration scenarios will be evaluated as detailed alternative plans are developed in the next phase of the feasibility study.